

APPENDIX A

Hawley's
Condensed Chemical
Dictionary

THIRTEENTH EDITION

Revised by
Richard J. Lewis, Sr.

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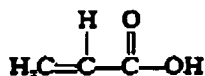
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ACRYLATE

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acrylate. (1) Any of several monomers used for the manufacture of thermosetting acrylic surface coating resins, e.g., 2-hydroxyethyl acrylate (HEA) and hydroxypropyl acrylate (HPA). (2) Polymer of acrylic acid or its esters, used in surface coatings, emulsion paints, paper and leather finishes, etc. See acrylic acid; acrylic resin.

acrylic acid. (acroleic acid; propenoic acid).
CAS: 79-10-7. $\text{H}_2\text{C}=\text{CHCOOH}$.



Properties: Colorless liquid; acrid odor. Bp 140.9°C, mp 12.1°C, d 1.052 (20/20°C), vap press 3.1 mm (20°C), bulk d 8.6 lb/gal (20°C), refr index 1.4224 (20°C). Flash p 130°F (54.5°C) (OC). Polymerizes readily. Miscible with water, alcohol, and ether. Combustible.

Derivation: (1) Condensation of ethylene oxide with hydrocyanic acid followed by reaction with sulfuric acid at 320°F; (2) acetylene, carbon monoxide, and water, with nickel catalyst; (3) propylene is vapor oxidized to acrolein, which is oxidized to acrylic acid at 300°C with molybdenum-vanadium catalyst; (4) hydrolysis of acrylonitrile.

Grade: Technical (esterification and polymerization grades), glacial (97%).

Hazard: Irritant and corrosive to skin. Toxic by inhalation. May polymerize explosively. TLV: 2 ppm in air.

Use: Monomer for polyacrylic and polymethacrylic acids and other acrylic polymers.

See acrylic resin.

acrylic fiber. A manufactured fiber in which the fiber-forming substance is any long-chain synthetic polymer composed of at least 85% (by weight) acrylonitrile units $-\text{CH}_2\text{CH}(\text{CN})-$ (U.S. Federal Trade Commission).

Properties: Tensile strength 2-3 g/denier, water absorption 1.5-2.5%, d approx 1.17. Combustible.

Hazard: Fumes are toxic.

Use: Modacrylic fibers; blankets; carpets.

See modacrylic fiber; acrylic resin.

acrylic polymers. See acrylic resin.

acrylic resin. (acrylic fiber; nitrile rubber).

Thermoplastic polymers or copolymers of acrylic acid, methacrylic acid, esters of these acids, or acrylonitrile. The monomers are colorless liquids that polymerize readily in the presence of light, heat, or catalysts such as benzoyl peroxide; they must be stored or shipped with inhibitors present to avoid spontaneous and explosive polymerization.

Properties: Acrylic resins vary from hard, brittle solids to fibrous, elastomeric structures to viscous liquids, depending on the monomer used and the method of polymerization. A distinctive property of

cast sheet and extruded rods of acrylic resin is ability to transmit light.

Use: Bulk-polymerized: hard, shatterproof, transparent or colored material (glass substitute, decorative illuminated signs, contact lenses, dentures, medical instruments, specimen preservation, furniture components). Suspension-polymerized: beads and molding powders (headlight lenses, adsorbents in chromatography, ion-exchange resins). Solution polymers: coatings for paper, textiles, wood, etc. Aqueous emulsions: adhesives, laminated structures, fabric coatings, nonwoven fabrics. Compounded prepolymers: exterior auto paints, applied by spray and baked. Acrylonitrile-derived acrylics are extruded into synthetic fibers and are also the basis of the nitrile family of synthetic elastomers. See acrylic acid; acrylonitrile; methyl methacrylate.

"Acryloid" coating resins [Rohm & Haas].

TM for acrylic ester polymers in organic solvent solutions or 100% solid forms; water-white and transparent. Films range from very hard to very soft.

Use: Exceptionally resistant surface coatings, such as heat-resistant and flameproof enamels; vinyl and plastic printing; fluorescent coatings; clear and pigmented coatings on metals.

"Acryloid" Modifiers [Rohm & Haas].

TM for thermoplastic acrylic polymers in powder form. Various grades facilitate processing or improve physical properties of rigid or semi-rigid polyvinyl chloride formulations.

"Acryloid" oil additives [Rohm & Haas].

TM for acrylic polymers supplied in special oil solution or in diester lubricant.

Use: Viscosity-index improvement, pour-point depression of lubricating oils and hydraulic fluids, sludge dispersancy in lubricating and fuel oils.

"Acrylon" [Borden]. TM for a group of acrylic rubbers outstanding in resistance to oil, grease, ozone, and oxidation.

Use: Gaskets and rubber parts for contact with oils and diester lubricants.

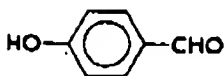
acrylonitrile. (propenenitrile; vinyl cyanide).

CAS: 107-13-1. $\text{H}_2\text{C}=\text{CHCN}$.

40th highest-volume chemical produced in U.S. (1995).

Properties: Colorless, mobile liquid; mild odor. Fp -83°C; bp 77.3-77.4°C, d 0.8004 (25°C), flash p 32°F (0°C) (TOC). Soluble in all common organic solvents; partially miscible with water.

Derivation: (1) From propylene oxygen and ammonia with either bismuth phosphomolybdate or a uranium-based compound as catalysts; (2) addition of hydrogen cyanide to acetylene with cuprous chloride catalyst; (3) dehydration of ethylene cyanohydrin.



Properties: Colorless needles. D 1.129, mp 116C (sublimes). Soluble in alcohol, ether, and hot water.
Use: Pharmaceuticals.

o-hydroxybenzamide. See salicylamide.

hydroxybenzene. See phenol.

2-hydroxy-1',2'-benzocarbazole-3-carboxylic acid. $C_{17}H_{11}NO_3$.

Properties: A four-ring structure, light-green powder. Mp 315–320C. Soluble in ethanol and acetone; insoluble in water.

Use: Manufacture of dye intermediates and other organic chemicals.

m-hydroxybenzoic acid.

CAS: 99-06-9. $C_7H_6(OH)COOH$.

Properties: White powder. Mp 200C. Soluble in water and hot alcohol.

Use: Intermediate for plasticizers, resins, light stabilizers, petroleum additives, pharmaceuticals.

o-hydroxybenzoic acid. See salicylic acid.

p-hydroxybenzoic acid.

CAS: 99-96-7. $C_6H_4(OH)COOH \cdot H_2O$.

Properties: Colorless crystals. D 1.46, mp 210C. Soluble in alcohol and ether; partially soluble in water.

Derivation: Interaction of p-aminobenzoic acid and nitrous acid.

Use: Intermediate, synthetic drugs, food preservative (up to 0.1%) (approved by FDA). Its methyl, propyl, and butyl esters are preservatives for cosmetics and pharmaceuticals.

2-hydroxybenzophenone. $C_{13}H_{10}O_2$.

Properties: Solid. Mp 41C, bp 210C (27 mm Hg). Insoluble in water; soluble in alcohol.

Use: UV absorber in plastics.

o-hydroxybenzyl alcohol. See salicyl alcohol.

β -hydroxybutyraldehyde. See aldol.

p-hydroxybutyranilide. (4'-hydroxybutyranilide). $C_{10}H_{11}NO_2$.

Properties: Acicular crystals. Mp 138C. Soluble in alcohol; partially soluble in hot water.

Use: Antioxidant for petroleum products.

β -hydroxybutyric acid.

CAS: 502-85-2. $CH_3CH(OH)CH_2COOH$.

Properties: Viscid yellow mass. Mp 48–50C, bp 130C (12 mm Hg). Very soluble in water, alcohol and ether.

1-HYDROXY-2,4-DIAMYLBENZENE

Derivation: Interaction of acetoacetic acid and sodium amalgam.

Grade: Technical, reagent.

Use: Intermediate.

2-hydroxycamphane. See borneol.

hydroxy- β -carotene. See cryptoxanthin.

3- β -hydroxycholestane. See dihydrocholesterol.

hydroxycitronellal. (citronellal hydrate; 3,7-dimethyl-7-hydroxyoctenal).

CAS: 107-75-5.

$(CH_3)_2C(OH)(CH_2)_3CH(CH_3)CH_2CHO$.

Properties: Viscous, colorless or faintly yellow liquid; sweet lily-type odor. D 0.925–0.930 (15C), refr index 1.448–1.450 (20C), optical rotation (Java type) +9 to +10.5 degrees, boiling range 94–96C (1 mm Hg). Soluble in alcohol (50%), fixed oils; slightly soluble in water, glycerol and mineral oil. Combustible.

Derivation: From citronellal (*Java citronella* or *Eucalyptus citriodora*).

Grade: Perfume, FCC.

Use: Perfumery (fixative, muguet odor), flavoring, soap and cosmetic fragrances.

hydroxycitronellal dimethyl acetal.

(hydroxyacetal).

$(CH_3)_2C(OH)(CH_2)_3CH(CH_3)CH_2CH(OCH_3)_2$.

Properties: Colorless liquid; light, floral odor. D 0.925–0.930 (25/25C), refr index 1.4410–1.4440 (20C). Soluble in most fixed oils, mineral oil, propylene glycol; insoluble in glycerol. Combustible.

Grade: Perfume, FCC.

Use: Flavoring agent in foods, perfumery.

hydroxycitronellal-methyl anthranilate Schiff base. $C_{14}H_{17}O_3N$.

Properties: Linden–orange-flower odor; yellow, honeylike, viscous liquid. Stable, refr index 1.5350–1.5460 (20C), flash p 206F (96.6C) (TCC). Soluble in two parts of 70% alcohol, one part of 80% alcohol. Combustible.

Use: Perfumery.

17-hydroxycorticosterone. See hydrocortisone.

2-hydroxy-p-cymene. See caracrol.

3-hydroxy-p-cymene. See thymol.

1-hydroxy-2,4-diamylbenzene. See diamyl phenol.

PHENIRAMINE MALEATE

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hol, ether, acetone, benzene; solutions in alkalis are red; in concentrated sulfuric acid blue.

Use: Medicine (blood anticoagulant).

pheniramine maleate. (prophenpyridamine maleate; 1-phenyl-1-(2-pyridyl)-3-di-methylamino-propane maleate).

CAS: 132-20-7. $C_{16}H_{20}N_2 \cdot C_4H_4O_4$.

Properties: White, crystalline powder; faint amine-like odor. Mp 104–108°C. Very soluble in alcohol and water; slightly soluble in benzene and ether, 1% solution has pH between 4.5 and 5.5.

Grade: NF.

Use: Medicine (antihistamine).

"Phenmad" [Mallinckrodt]. TM for a 10% phenylmercuric acetate aqueous solution.

Use: Turf fungicide.

Hazard: Highly toxic.

phenobarbital. (phenylbarbital; phenylethylmalonylurea; 5-ethyl-5-phenylbarbituric acid).

CAS: 50-06-6. $C_{12}H_{12}N_2O_3$.

Properties: White, shining, crystalline powder; odorless; stable. Mp 174–178°C. Soluble in alcohol, ether, chloroform, alkali hydroxides, alkali carbonate solutions; sparingly soluble in water.

Derivation: Condensation of phenylethylmalonic acid derivatives and urea.

Grade: USP.

Hazard: May have damaging side effects.

See barbiturate.

Use: Medicine (sedative), laboratory reagent. Also available as the sodium salt, which has good water solubility.

phenocoll hydrochloride.

(aminoacetophenetidide hydrochloride; glycocoll-*p*-phenetidide hydrochloride).

$C_9H_9O_3N_2 \cdot NH_2 \cdot HCl$.

Properties: Fine, white, crystalline powder. Mp 95°C. Soluble in water and warm alcohol; slightly soluble in chloroform, ether, and benzene.

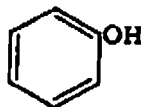
Derivation: By the action of aminoacetic acid upon phenetidide and acidifying.

Use: Medicine (analgesic).

phenol. (1) A class of aromatic organic compounds in which one or more hydroxy groups are attached directly to the benzene ring. Examples are phenol itself (benzophenol), the cresols, xylenols, resorcinol, naphthols. Though technically alcohols, their properties are quite different.

(2) Phenol (carbolic acid; phenylic acid; benzo-phenol; hydroxybenzene).

CAS: 108-95-2. C_6H_5OH .



34th-highest-volume chemical produced in U.S. (1995).

Properties: White, crystalline mass that turns pink or red if not perfectly pure or if under influence of light; absorbs water from the air and liquefies; distinctive odor; sharp burning taste. When in very weak solution it has a sweetish taste. D 1.07, mp 42.5–43°C, bp 182°C, flash p 172.4°F (78°C) (CC), autoign temp 1319°F (715°C). Soluble in alcohol, water, ether, chloroform, glycerol, carbon disulfide, petrolatum, fixed or volatile oils, and alkalis. Combustible.

Derivation: Most of the phenol in the U.S. is made by the oxidation of cumene, yielding acetone as a by-product. The first step in the reaction yields cumene hydroperoxide, which decomposes with dilute sulfuric acid to the primary products, plus acetophenone and phenyl dimethyl carbinol. Several other benzene-based processes have been used in the past; derivation from benzoic acid is also possible.

Method of purification: Rectification.

Grade: Fused, crystals, or liquid, all as technical (82, 90, and 95%, other components mostly cresols), CP, and USP.

Hazard: Toxic by ingestion, inhalation, and skin absorption; strong irritant to tissue. TLV: 5 ppm in air.

Use: Phenolic resins, epoxy resins (bisphenol-A), nylon -6 (caprolactam), 2,4-D, selective solvent for refining lubricating oils, adipic acid, salicylic acid, phenolphthalein, pentachlorophenol, acetophenetidin, picric acid, germicidal paints, pharmaceuticals, laboratory reagent, dyes and indicators, slimicide, biocide, general disinfectant.

Note: High-boiling phenols are mixtures containing predominantly *m*-substituted alkyl phenols. Their boiling points range from 238 to 288°C; they set to a glass at –30°C.

phenolate process. A process for removing hydrogen sulfide from gas by the use of sodium phenolate, which reacts with the hydrogen sulfide to give sodium hydrosulfide and phenol. This can be reversed by steam heat to regenerate the sodium phenolate.

phenol coefficient. In determining the effectiveness of a disinfectant using phenol as a standard of comparison, the phenol coefficient is a value obtained by dividing the highest dilution of the test disinfectant by the highest dilution of phenol that sterilizes a given culture of bacteria under standard conditions of time and temperature.

See disinfectant.

phenoldisulfonic acid. $C_6H_4O_3S_2$.

Properties: Deliquescent crystals. Mp 90°C. Decomposes above 100°C; soluble in water and alcohol.

Use: Manufacture of dye intermediates.

phenol-formaldehyde resin. The first synthetic thermosetting polymer; the reaction product of phenol with aqueous 37–50% formaldehyde at 50–100°C, with basic catalyst, discovered by Bakeland

salicyl alcohol. (*o*-hydroxybenzyl alcohol; α -2-dihydroxytoluene; saligenin).
CAS: 90-01-7. $\text{HOC}_6\text{H}_4\text{CH}_2\text{OH}$.

Properties: White crystals; pungent taste. Mp 86–87°C, d 1.16, sublimes at 100°C. Very soluble in alcohol, chloroform, ether; soluble in propylene glycol, benzene, and fixed oils; sparingly soluble in cold water; soluble in hot water. Combustible.

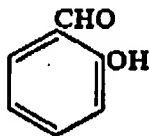
Derivation: Hydrolysis of salicin, heating phenol and methylene chloride with caustic.

Use: Medicine (local anesthetic).

salicyl alcohol glucoside. See salicin.

salicylaldehyde. (salicylal; salicylic aldehyde; *o*-hydroxybenzaldehyde).

CAS: 90-02-8. $\text{C}_6\text{H}_4\text{OHCHO}$.



Properties: Colorless, oily liquid or dark-red oil; bitter, almondlike odor; burning taste. D 1.165–1.172, fp –7°C, bp 196°C, flash p 172°F (77.7°C). Soluble in alcohol, ether, and benzene; slightly soluble in water. Combustible.

Derivation: Interaction of phenol and chloroform in presence of aqueous alkali.

Use: Analytical chemistry, perfumery (violet), synthesis of coumarin, auxiliary fumigant, flavoring.

salicylamide. (*o*-hydroxybenzamide).

CAS: 65-45-2. $\text{C}_6\text{H}_4(\text{OH})\text{CONH}_2$.

Properties: White or slightly pink crystals. Mp 139–142°C, bp decomposes at 270°C. Soluble in hot water, alcohol, ether, chloroform; slightly soluble in cold water, naphtha, and carbon tetrachloride.

Derivation: Treatment of methyl salicylate with dry ammonia gas.

Grade: Technical, NF.

Use: Medicine (analgesic).

salicylanilide.

CAS: 87-17-2. $\text{HOC}_6\text{H}_4\text{CONHC}_6\text{H}_5$.

Properties: Odorless, white, or slightly pink crystals. Mp 136–138°C, bp (decomposes), stable in air. Slightly soluble in water; freely soluble in alcohol, ether, chloroform and benzene.

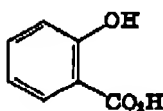
Grade: NF.

Hazard: Toxic by ingestion, irritant to skin.

Use: Fungicide, slumicide, antimildew agent, intermediate.

salicylic acid. (*o*-hydroxybenzoic acid).

CAS: 69-72-7. $\text{C}_6\text{H}_4(\text{OH})(\text{COOH})$.



Properties: White powder; acrid taste. Stable in air but gradually discolored by light. D 1.443 (20/4°C), mp 158–161°C, bp 211°C (20 mm Hg), sublimes at 76°C. Soluble in acetone, oil of turpentine, alcohol, ether, benzene; slightly soluble in water. Combustible.

Derivation: Reacting a hot solution of sodium phenolate with carbon dioxide and acidifying the sodium salt thus formed.

Grade: Technical, USP, crude.

Hazard: Dust forms explosive mixture in air. Toxic by ingestion.

Use: Manufacture of aspirin and salicylates, resins, dyestuff intermediate, prevulcanization inhibitor, analytical reagent, fungicide.

salicylic acid dipropylene glycol monoester.

See dipropylene glycol monosalicylate.

salicylic aldehyde. See salicylaldehyde.

saligenin. (salicyl alcohol). $\text{C}_6\text{H}_4(\text{OH})\text{CH}_2\text{OH}$.

Use: Treatment for rheumatism.

saline water. See brine; ocean water.

salinity. The saltiness of natural water. The salinity of normal seawater is 35 parts salt per 1000 parts water.

salmine. A protein specific to the salmon.

Use: Nutritional and biochemical research.

salol. See phenyl salicylate.

saloquinine. (salicyl quinine.)

$\text{HOC}_6\text{H}_4\text{COOC}_{20}\text{H}_{23}\text{N}_9$

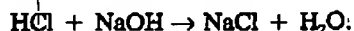
Use: Antipyretic, antiperiodic.

sal soda. (washing soda; sodium carbonate decahydrate). $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$.

Properties: White crystals. D 1.44, mp 32.5–34.5°C (loses water at this temperature). Easily soluble in water; insoluble in alcohol. A pure form of sodium carbonate (soda ash).

Use: Washing textiles, bleaching linen and cotton, general cleanser.

salt. (1) The compound formed when the hydrogen of an acid is replaced by a metal or its equivalent (e.g., an NH_4^+ radical). Example:



This is typical of the general rule that the reaction of an acid and a base yields a salt and water. Most inorganic salts ionize in water solution.

(2) Common salt, sodium chloride, occurs widely in nature, both as deposits left by ancient seas and in the ocean, where its average concentration is 2.6%.

See sodium chloride; soap.

salt bath. A molten mixture of sodium, potassium, barium, and calcium chlorides or nitrates to which

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